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## ABSTRACT

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Methods and apparatuses are described for detecting volumetric moisture content and conductivity in various media based on a time-domain reflectometry (TDR) system wherein successive fast transitions are injected into a transmission line immersed in a medium of interest, and a characteristic received waveform is digitized and analyzed by continuously sampling multiple received waveforms at short time intervals. One method transmits a timing signal along a shielded transmission line while a coincident signal is transmitted through the medium of interest. Another method propagates the waveform along a transmission line, that may be either shorted or open-ended, and observes a reflected, rather than transmitted, waveform with a receiver connected to the same end of the transmission line as the transmitter. The effects of dispersion caused by the conductive and dielectric properties of the medium on the waveform in an unshielded transmission line are extrapolated by detecting the bulk propagation time and the slope of the distorted rising edge of the characteristic received waveform. Absolute volumetric moisture percentage is inferred from propagation time, and absolute conductivity is inferred from the maximum slope value of the distorted rising edge of the characteristic received waveform.